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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

MAI, ANH D

ART UNIT

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/680,260	Applicant(s) ABRAHAM ET AL.	
	Examiner Anh D. Mai	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,5-23,25 and 26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,5-23,25 and 26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/09/2007</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Status of the Claims

1. The Remarks filed January 30, 2007 has been entered. Claims 1, 2 and 5-26 are pending.

Petition Under 37 C.F.R. §1.181

2. The Petition filed January 30, 2007 has been reviewed and the Objection to claim 13 has been withdrawn.

Specification

3. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

METHOD FOR PATTERNING OF A MAGNETIC THIN FILM USING FLUORINE-CONTAINING PLASMA GASEOUS TO TRANSFORM A MAGNETIC PORTION TO NON-MAGNETIC.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 1, 2, 5-23, 25 and 26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

There does not appear to be a written description of the claim limitation “wherein said reactive plasma includes O₂ and a fluorine-containing gas” in the application as filed.

In the context of cancelled claim 24, the two gases “O₂ and fluorine-containing gas” are in a Markush group. Since the specification only provide support for plasma fluorine-containing gas to form an insulating pattern.

According to the Remarks, O₂ and fluorine-containing gas are intended to be used as a combination.

However, the specification fails to support that assertion.

How, when and where does the magnetic thin film pattern being exposed to O₂ ?

Therefore, the “reactive plasma includes both O₂ and fluorine-containing gas” is new matter.

Applicant must cancel the new matter in response to this office action.

5. Claims 1, 2, 5-23, 25 and 26 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Amended claim 1, line 5 recites: wherein said reactive plasma includes O₂ and a fluorine-containing gas.

However, the specification fails to enable one skilled in the art to make the invention, since only fluorine-containing gas is shown.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 13 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 13, recites: the method of claim 1, further comprising producing a magnetic device.

What is the magnetic device ?

Is the device produced by claim 1 not a magnetic device ?

What is the difference between the magnetic device produced by claim 1 and that of claim 13 ?

What is the process step of “producing a magnetic device” ?

Claim 13 recites “further comprising: producing a magnetic device” but without providing any other process steps that already recited in claim 1, thus, claim 13 is indefinite.

The following is a quotation of the **fourth paragraph of 35 U.S.C. 112**:

A dependent claim shall specify a further limitation of the subject matter of claim which it refers.

7. Claim 13 is rejected under 35 U.S.C. 112, fourth paragraph, for failing to specify a further limitation of the subject matter of claim 1 to which it refers.

Claim 13 recites: the method of claim 1, further comprising: producing a magnetic device.

Since the term “producing a magnetic device” does not further add any other process step to the method of claim 1, claim 13 fails to further limit the method of claim 1. See *Pfizer Inc. v. Ranbaxy Laboratories Ltd.*, 79 USPQ2d 1583 (Fed. Cir. 2006).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1, 2, 5-11, 13-15, 17, 19, 22, 23, 25 and 26 are rejected under 35 U.S.C. 102(b) as being anticipated by Kamata et al. (U.S. Pub. No. 2002/0142192) of record.

With respect to claim 1, Kamata teaches method of patterning a magnetic thin film as claimed including:

transforming a portion of the magnetic thin film (20, 330, 350) to be non-magnetic and electrically insulating (40, 370) using a chemical transformation, the chemical transformation comprises using a fluorine-based reactive plasma,

wherein the reactive plasma includes O₂ and a fluorine-containing gas. (See Figs. 3A-B, 13A-B).

With respect to claim 2, the method of Kamata further includes: providing a mask (30, 360) over the portion of the magnetic thin film (20) to be preserved using photolithography.

With respect to claim 5, the fluorine-based reactive plasma of Kamata CF₄, SF₆, CHF₃.

With respect to claim 6, the pressure used in the converting of Kamata is within a range of about 10 mT to about 30 mT.

With respect to claim 7, the portion of the magnetic thin film (20) of Kamata comprises of alloys of nickel, iron, and cobalt, and the converting comprising converting the alloys of nickel, iron, and cobalt, to a fluorine-containing film.

With respect to claim 8, the fluorine-containing film (40) is non-ferromagnetic.

With respect to claim 9, the fluorine-containing film (40) of Kamata is non-magnetic.

With respect to claim 10, the fluorine-containing film (40) of Kamata is electrically insulating.

With respect to claim 11, the mask (30) of Kamata comprises a photoresist.

With respect to claim 13, the method of Kamata further includes: producing a magnetic device.

With respect to claim 14, the using chemical transformation of Kamata can be performed at room temperature.

With respect to claim 15, the reactive plasma of Kamata includes a fluorocarbon.

With respect to claim 17, the reactive plasma of Kamata includes sulfur hexafluoride.

With respect to claim 19, the pressure of Kamata is selectively employed for the plasma sputtering such that the magnetic thin film material (20) is substantially free of erosion.

With respect to claim 22, the mask of Kamata comprises an insulating hard mask (360), the method of Kamata further includes: after the converting, selectively etching the insulating hard mask (360) to pattern the insulating hard mask.

With respect to claim 23, the method of Kamata further includes: forming a conductive material (380) over the area where the insulating hard mask (360) was etched.

With respect to claim 25, the magnetic thin film (20) of Kamata includes a magnetic tunnel junction (MTJ), and wherein after the converting portion, the edges of the magnetic tunnel junction have no exposure to oxygen. (see Figs 13).

With respect to claim 26, the edge smoothness of the MTJ of Kamata is inherently determined by a line edge roughness of the mask (360).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192 as applied to claim 2 above, and further in view of Ning et al. (U.S. Pub. No. 2002/0098676) of record.

With respect to claim 12, Kamata teaches providing a mask over a portion of the magnetic thin film for patterning.

Thus, Kamata is shown to teach all the features of the claim with the exception of utilizing a metal hard mask.

However, Ning teaches utilizing photolithography to provide a mask including TaN, TiN (244) for patterning.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to provide a hard mask of Kamata including a TiN and TaN as taught by Ning for patterning over the portion of the magnetic thin film.

10. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata as applied to claim 1 above, and further in view of Baglin et al. (U.S. Patent No. 6,331,364) of record.

Kamata teaches converting a portion of a magnetic thin film by a reactive plasma.

Thus, Kamata is shown to teach all the features of the claim with the exception of using argon for the reactive plasma.

However, Baglin teaches other ion species that may be used to converting a magnetic thin film including argon. (See col. 10, lines 9-13).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to convert a portion of the magnetic thin film of Kamata utilizing argon plasma as taught by Baglin to achieve the desired chemical conversion.

11. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192.

Kamata teaches converting a portion of the magnetic thin film (20) into non-magnetic insulating (40).

Thus, Kamata is shown to teach all the features of the claim with the exception of explicitly to include bromide.

However, Kamata teaches the reactive gas containing halide. It is well known that bromide is a member of halide gas.

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to convert a portion of the magnetic thin film of Kamata utilizing bromide, since bromide as well as iodide, fluoride or chloride are members of reactive gas known as halide.

12. Claims 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kamata '192 as applied to claim 1 above, and further in view of Chen et al. (U.S. Patent No. 6,165,803) of record.

With respect to claim 20, Kamata teaches converting a portion of magnetic thin film (20) by reactive plasma.

Thus, Kamata is shown to teach all the features of the claim with the exception of further process step.

However, Chen teaches process steps following the conversion including:

forming an insulating layer (72) over the converted portion (42b) of the magnetic thin film (42) and the mask (52); and

etching the insulating layer (72) and the mask (52) to planarize the upper level of the mask (52) and the insulating layer (72). (See Fig. 12).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention was made to further process the converted magnetic thin film of Kamata utilizing the further process step as taught by Chen to form the MTJ device.

With respect to claim 21, the method of Chen, further includes:

selectively etching the mask (52); and forming a conductive material (70) over the insulating layer (72) and the area where the mask (52) was selectively etched. (See Fig. 13).

Response to Arguments

13. Applicant's arguments filed July 10, 2006 have been fully considered but they are not persuasive.

Claim Objection

The Objection to claim 13 has been withdrawn. However, claim 13 is now rejected under 35 U.S.C. 112, fourth paragraph for failing to specify a further limitation of the subject matter of claim 1 to which it refers.

The Rejection Under 35 U.S.C. 112, first paragraph, new matter

Applicant asserts that the limitation “wherein the reactive plasma includes O₂ and fluorine-containing gas” has been recited in cancelled claim 24. Thus written description is met.

However, throughout the specification, **not once**, the disclosure has never shown the reactive gas, plasma, being a combination of gaseous fluorine and oxygen together.

Only fluorine-based gas is intended.

With all intended purpose of the application, the fluorine-based gas uses in the instant invention is distinguished from the admitted prior art uses of well known oxygen plasma.

Yet, original claim is the disclosure. However, failing to show, in detail, how the two gases being used together, clearly raise the new matter issue.

Clearly, the written description is lacking.

The reason to establish the Murkush group can be seen from the specification, where the prior art teaches the well known conversion utilizing oxygen plasma and the instant invention using fluorine-based gas, individually, hence, claim 24, *said reactive plasma includes O₂ and fluorine-containing gas*.

The rejection is maintained.

The Rejection Under 35 U.S.C. 112, first paragraph, enablement

Other than claim 24, Applicant refuses to direct this Examiner to the specific portion of the invention which specifically teaches the use of fluorine and oxygen gases together.

The Applicant statement regarding the skilled in the art would make the invention based on the disclosure.

Said statement is the same as teaching the skilled in the art to make diamond includes using carbon and high temperature.

At best, the specification only shows fluorine-based gas is used and completely silent on the so called oxygen plasma. The closest oxygen plasma has ever been discussed is the prior art's method.

The rejection is maintained.

The Rejection Under 35 U.S.C. 112, second paragraph

The Applicant asserts:

Applicants have **repeatedly** pointed out that claim 1 does not recite "producing a magnetic device". Indeed, claim 1 clearly recites "*a* method of patterning a magnetic thin film". Claim 1 does not produce a magnetic device. Claim 13, however, recites the additional method step of forming a magnetic device.

However, "patterning a magnetic thin film" has already "producing a magnetic device" because, patterning a layer is producing that layer with a refine feature.

What is the different between the patterned magnetic film of claim 1 and the magnetic film produced in claim 13 ?

Note that, the "detail" magnetic device as shown in Figs. 2A-C has never recited in claim 13. It is noted that the features upon which applicant relies (i.e., Figs. 2A-C, 3) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

The rejection is maintained.

Rejection under 35 U.S.C. 102(b) and 103(a):

With respect to **Kamata**, Applicant argues: Kamata does not teach or suggest “*wherein said reactive plasma includes O₂ and a fluorine-containing gas*”, as recited in exemplary claim 1.

Kamata clearly teaches the magnetic thin film being exposed to reactive plasma includes fluorine-containing gas and oxygen gas. (See at least [0070] and [0181]).

As clearly indicated in paragraphs [0070] and [0181], the magnetic thin film of Kamata is clearly being exposed to plasma includes fluorine-based and oxygen.

If oxygen plasma has any effect on the magnetic thin film of the instant invention, then the same inherently happens to the magnetic thin film of Kamata when it is exposed to oxygen plasma.

Applicant further argues: Kamata does not teach or suggest a plasma that includes both O₂ and a fluorine-containing gas. That is, Kamata teaches separate steps of using a halogen-containing plasma and oxygen ashing.

Note that the limitation of the claims is: “wherein said reactive plasma includes O₂ and a fluorine-containing gas”.

This limitation clearly does not exclude the two plasma being used in separate steps.

The rejection is maintained.

With respect to **Ning**, as discussed above, Kamata teaches all limitation of Claim 1 including “reactive plasma includes O₂ and a fluorine-containing gas”. Ning, on the other hand, has been cited to show that other materials can be used for the mask for patterning.

Applicant further adds: the Examiner has not provided a motivation or suggestion to combine the teachings of the prior art references. That is, the Examiner merely alleges “it would have been obvious to one having ordinary skill in the art at the time of invention to provide a hard mask of Kamata including a TiN and TaN as taught by Ning **for patterning** over the portion of the magnetic thin film” (see Office Action dated January 3, 2007 at page 8).

The used of different materials for the same intended purpose, for patterning, is motivation in itself. See *In re Leshin*, 125 USPQ 416., 125 USPQ 416 and *KSR*.

The rejection of claim 12 is maintained.

With respect to **Baglin**, as discussed above, Kamata teaches all limitation of Claim 1 including “reactive plasma includes O₂ and a fluorine-containing gas”. Baglin, on the other hand, has been cited to show that other than the main reactive gas, argon is a known gas can be used along the main reactive gas to achieve the desired chemical conversion.

The rejection of claim 16 is maintained.

With respect to **Chen**, as discussed above, Kamata teaches all limitation of Claim 1 including “reactive plasma includes O₂ and a fluorine-containing gas”. Chen, on the other hand, has been cited to show that further steps are utilized to form a particular feature of the device.

The rejection claims 20 and 21 are maintained.

Conclusion

14. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 8:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Anh D. Mai/
Primary Examiner, Art Unit 2814